Geometry Notes

krista king
MATH

Interior angles of polygons

In this lesson we'll look at how to find the measures of the interior angles of polygons by using a formula.

Triangles

Triangles are 3-sided polygons. Remember that the three angles of any type of triangle add up to $180°$. For instance, in this figure, $m\angle 1 + m\angle 2 + m\angle 3 = 180°$.

Polygons

The word "polygon" means "many-sided figure." A polygon has the same number of angles as it has sides, and a regular polygon has equal angles and equal sides.

Any polygon can be divided into triangles.

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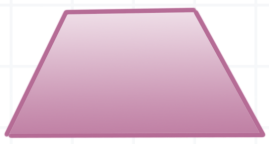
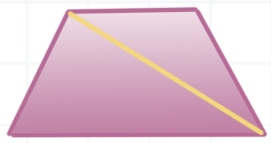
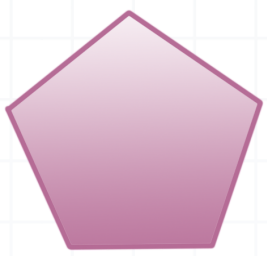
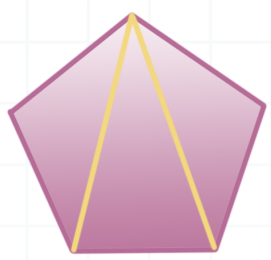
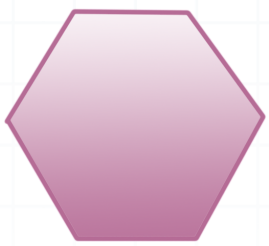
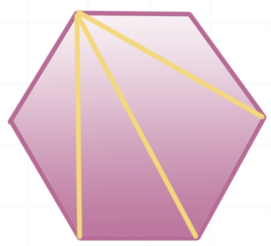
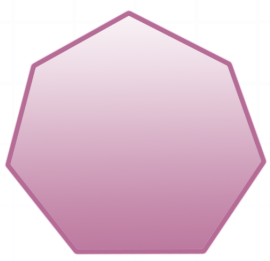
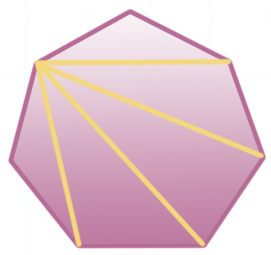
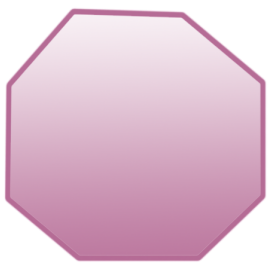
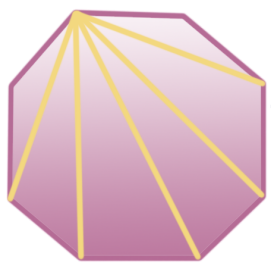
Picture	Name	Sides	Triangles	Degrees inside
	Quadrilateral	4	2: 	$2(180^\circ) = 360^\circ$
	Pentagon	5	3: 	$3(180^\circ) = 540^\circ$
	Hexagon	6	4: 	$4(180^\circ) = 720^\circ$
	Heptagon	7	5: 	$5(180^\circ) = 900^\circ$
	Octagon	8	6: 	$6(180^\circ) = 1{,}080^\circ$
	...	...	...	...
	n-gon	n	$n-2$	$(n-2)180^\circ$

Let's start by working through an example.

Example

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What is the measure of each individual angle in a regular icosagon (a 20-sided figure)?

The sum of the angles in a polygon is $(n-2)180°$, where n is the number of sides in the polygon. For an icosagon, which is a 20-sided figure, that would be

$$(20-2)180° = 3{,}240°$$

There are 20 congruent interior angles because the shape is regular, so each interior angle measures

$$3{,}240° \div 20 = 162°$$

If the shape is not regular then you can't assume all of the angles are congruent. Let's look at an example with non-regular interior angles.

Example

What is the measure of $\angle Z$?

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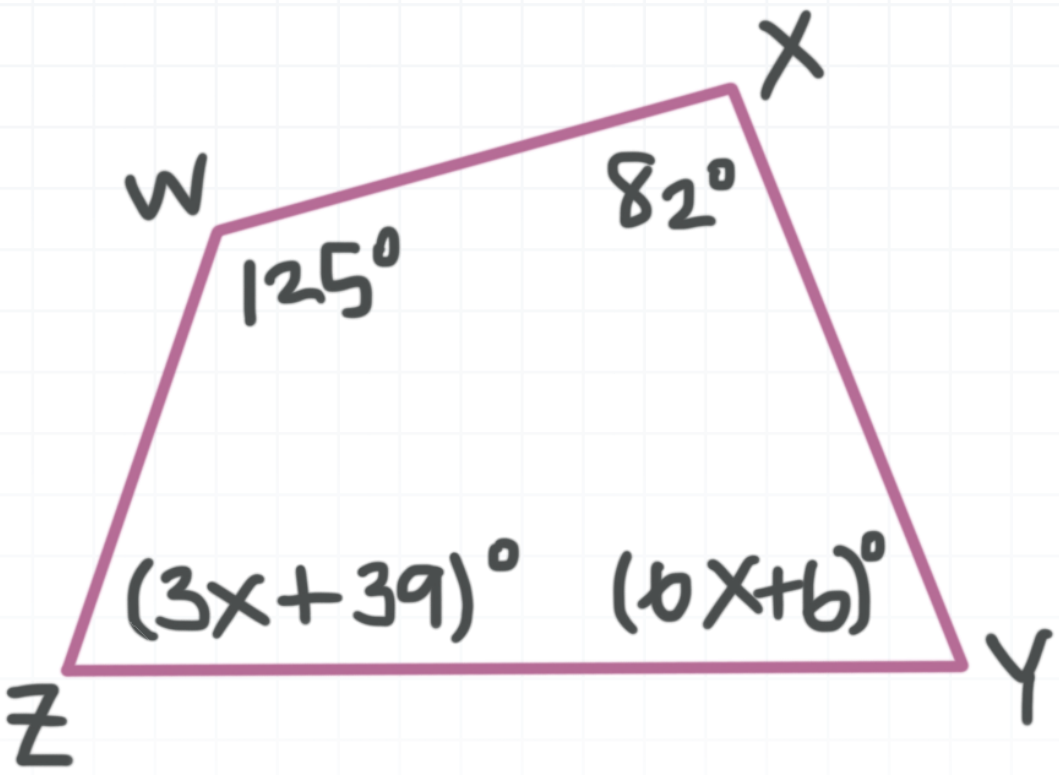

The sum of the angles in a polygon is $(n-2)180^\circ$. For a quadrilateral, that would be $(4-2)180^\circ = 360^\circ$. Set the sum of the four angles equal to 360° and then solve for x.

$$125^\circ + 82^\circ + 3x + 39^\circ + 6x + 6^\circ = 360^\circ$$

$$252^\circ + 9x = 360^\circ$$

$$9x = 108^\circ$$

$$x = 12^\circ$$

Substitute 12° for x in $(3x+39)^\circ$ to find $m\angle Z$.

$$m\angle Z = (3 \cdot 12 + 39)^\circ = 75^\circ$$

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